TPM Volume-14

Total Preventive Maintenance

Cost reduction-2 & Oil control-4

2021a Edition

Koichi Kimura

Factory Management Institute

COOPERATING TO REACH EXCELLENCE

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At the time of publication and over the age of 75, he continues working on the dissemination of original Japanese methods and more knowledge even the one learned from the pioneers and, continues working as an international consultant for the last 23 years in more than 11 countries, training clients, as a lecturer and writer. Even now, experimenting and researching innovative methods and growing in the field of Production Management and Corporate structuration.

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Content

Icons:

Notes: Going and Comeback to the main theme.

Third level of the Issue, in order to provide more clearness to the structure of the text.

Lower levels of the Issue, commonly 6th or 7th And, pointing out necessary explanations about pictures or graphs.

UPDATING TABLE:

Date, Version-Previous & V-Next	Chapter (I..XX...)	Chapter Point.- sub-point : (Updating)

I. Introduction

I'm writing the theme of Cost because sometimes I see a very funny or strange phenomenon in a company.

Cost

This is a very important factor to manage a company. But unfortunately, it is too little that managers understood Cost correctly. And, I see the company that uses its data wrongly. This lecture about "teaching the company" can also be used to understand the cost data for the "Prohibition of Receiving order in Red" policy. I said to the management team, this policy is wrong. If it is possible to gain and continue the business within the policy, it is the best. However, sometimes there is an occasion that the business should be gained or continued, even though the business is the condition of "Receiving in Red". By no corrective consideration, losing opportunity is a big mistake. Why does such a mistake happen? Because Cost has various faces.

Then What is Cost? … Variable cost, Fixed cost, Direct cost, Indirect cost, Predetermined cost, Allocation, etc. And, Cost, Cost, Cost, etc. We know that Cost is important for company management. However. It is indeed complex and troublesome, but the knowledge of cost is essential.

And, Cost has some faces. Therefore, it is troublesome.

And it is risky to handle a company with just cost. However, if the product has special superiority in the market, the cost-focused tactic can be succeeded.

But normally it is to seek the maximization of "Marginal profit". (I didn't write it yet. But one of the final targets to describe Cost is this maximization of Marginal Profit).

Marginal Profit

Maximization of marginal profit is my intention to write this column.

Even if operating income is in the red, if marginal profit is in the black, operating income may turn into the black by increasing sales or reducing fixed costs. On the other hand, if the marginal profit is in the red, the deficit will increase even if sales are increased, so it is necessary to make a decision such as suspending the business.

Another message is; What is the purpose of TPM? …I wrote the purpose of TPM is:

1. To pursue "JIT machine condition in economic balance" and,
2. To extend "the machine's healthy lifespan".

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II. Cost Reduction-2

The continuation of the series of Cost reduction-2. And, this time, I write it with the story of the Teaching Company.

This company's president was from the accounting field. Please never misunderstand. The president who is from the accounting field is never bad, and (I personally recommendable) is good. In somewhere, I have written that: "*Engineer pursues dreams and accounting pursues numbers*". And they need to recognize the bias when a managing company.

In this company, there were some repeated fierce debates. And I have got an opportunity to listen to some of it. But in summary:

1. The position of the Accounting Manager was "Never receive the order in red. (This is one of the Top policies)".
2. Sales Manager; "The cost is too high and no cost competitiveness, and it is not possible to expand the sales amount in such cost situation".
3. Production Manager; "We need to make an effort to improve cost, but too little receiving order amount. Lack of effort of sales".
4. And closing the circle, Accounting Manager; "Why not increase sales amount. The inventory is increasing".

According to the Accounting Manager (or Director), the same barren arguments were repeated recently. And he told me —Sensei, how can we resolve this infinite barren argument? Haven't you good advice? Please advise us.

—Sorry, my professional field areas are Factory management, but sales issue is not my professional field –I answered.

—But Sensei — Accounting Manager questioned—, Cost Reduction is one of the major themes of Factory management, isn't it —he asked.

—Our contract is anyway the introduction of Total Preventive Maintenance — I said, although inside I felt an abominable being.—. I knew that you desire to recover the profit in cost reduction. And I told you that my support about cost recovery is to find and make the cost reduction & profit internally.

—We thank you for your help and advice such as the project activity —Accounting Manager recognized—, transfer from outsourcing to in-house manufacturing, etc. Although, you knew our true desire which is profit recovery in reducing cost and also that our company becomes a crisis if continuing such situation. And if you accept our proposal, we discuss with the owner president about the range of consultancy. Actually, we have suggested and discussed this matter with him when we changed the outsourcing policy. But he (the president) disagreed with our offer. Because still, he believes the TPM of Total "Productive" or Production Maintenance or Management includes such factory management themes. Of course, we understand that his TPM is never sufficient to cover the issue of factory management such as Cost Reduction —and Accounting Manager continued.

—If you accept and, if we could persuade him, he would be very happy. But if not… —Accounting Manager sighed—. Could we ask you to continue current teaching which actually, you are teaching us about the cost reduction issue in over the range of TPM?

In my heart, I feel so much “If”, “if” and more “if, some kind of annoying. I haven’t met and seen the president and I cannot believe such Top person. I wish to draw my hand from such a manufacturing company which the president doesn’t show up and the end is in sight.

—I understand —I admitted—. You require me the suggestion of Cost Reduction. Well then, please implement the next 2 things urgently. —and I remarked— Yes, urgently: One is to stop the policy of “Prohibit receiving an order in red” and, another is to establish the tag-team of Engineering and Sales.

1. What is Cost?

In TPM-13, I wrote the case of “Receiving order in red” of this teaching company and I told, also, that it is necessary to decide to receive the order in red in some cases.

And these cases should satisfy next conditions:

a) The expectation of sales expansion.
b) The expectation of internal cost reduction to profit recovery.

My previous company (SUMITOMO Wiring) and, my division.

The wiring harness business was (and is) profitable as the total. But when looking more exactly, HONDA and Nissan businesses were even or red. And, just Toyota business was profitable.

When looking at HONDA’s business, it is necessary to see the businesses of wiring harness, parts & components and, electric cable business as total. And the parts & components and electric cable were (are) different divisions and supplied to wiring harness assembly business which was my division. My division was in red always. And I always was blamed and felt small in the monthly management team meeting and was required stronger countermeasures to reduce this “red”. Unfortunately, my division wasn’t expected to be profitable but was expected to minimize red. One time I planned an action plan to minimize red which was to purchase wiring harness cable and parts from outside. And, I provided the materials and the quotations of outsourcing. I remember that I could reduce red if it was possible to implement. But as you understand my idea wasn’t accepted. Wiring harness business alone was in red numbers, but including the cable & parts production as the total business was profitable.

In 1978, HONDA Ohio (HAM; Honda of America Manufacturing. The earliest overseas expansion as the Japanese car manufacturer.) started its manufacturing. And, my company also opened other manufacturing companies in the US and Mexico, moreover expanding wiring harness business worldwide.

I think if we gave up and stopped the business of wiring harnesses alone, we couldn’t have current business prosperity. Thus, the top management of my previous company was excellent.

Honda business (or Nissan) alone was in red. But they forecasted the future such trends of worldwide motorization, world business expansion.

Now we come back to this teaching company…

2. To stop the policy of “Prohibit the receiving an order in red”.

I wrote the condition of “receiving in red” as next.

a) The expectation of sales expansion. And,
b) The expectation of internal cost reduction to the profit recovery.
And there is an additional condition even though the business to be "receive in red". Already you may understand.
c) The condition is if the company has the spare capacity to produce.

Thus, going back to "What is cost", I questioned the meeting which all departments' managers (directors) attended.

—Sales Manager, please —I asked him—, What is your saying Cost to judge "receiving an order in red"?

—Well —Sales Director thought for a while and answered then—, I can gain the information by Accounting and which is the "Individual Product Costing". And as you know we are prohibited to make sales under this condition. But it is quite true and, is recognized by all that there is no cost competitiveness at such a high cost. The production department should break through this situation. If not…

—Of course —Production Manager answered—, we understand and we make our effort. But never forget, our people are waiting for the food in the form of a production order. It is the top decision that keeping capacity and receiving new sales and then expanding business performance.

After some furious arguments and discussions, I tried to calm down everybody —OK, OK please stop the argument everyone —and then, I asked both Sales and Accounting Directors—. Individual Product Costing? Is it normally say Product Costing, isn't it? —everybody agreed.

Product Costing. (From Wikipedia)

In the mid-19th century, the Industrial Revolution established industry, and determining the selling price of industrial products became an important issue for businesses. In order to calculate how much a product would make a profit, it was necessary to clarify how much it cost to manufacture the product. Therefore, a method was devised to record the cost of manufacturing the product in double-entry bookkeeping and total it.

At the beginning of the 20th century, the industry entered an era of mass production of the same standard products. In factories that carry out mass production, the disadvantage of individual product costing, which is troublesome to carry out and increases management costs, has become more strongly recognized, and new costing methods have been devised. That is, the birth of Process costing. In factories that mass-produce products of the same standard, Process costing has demonstrated excellent capabilities and has replaced Process costing. However, Product costing is often used for made-to-order products.

The procedure is:

a) Fill out the costing sheet

Create a costing sheet for each product and total the costs. On the costing sheet, the manufacturing order number, customer name, product name, specifications, quantity, manufacturing order issuance date, manufacturing start date, product completion date, product delivery date, as well as direct material cost, direct labour cost, direct expense, manufacturing overhead cost record column, and selling price,

direct material cost, direct labour cost, direct expense, manufacturing overhead cost, manufacturing cost, sales management cost, total cost, estimate of profit, actual result, difference. There is a summary field to fill in. Enter the estimated amount for each item in the summary column in advance before manufacturing.

b) Manufacturing direct cost

Since the direct manufacturing cost is a cost that it is clear which product is incurred and how much, it is calculated individually for each product. This is called a charge or a direct charge.

c) Manufacturing overhead

Since manufacturing overhead is a cost for which it is not clear how much was incurred for which product, manufacturing overhead is allocated to each product based on a certain allocation standard. This is called allocation. The allocation procedure is as follows.

The allocation amount is calculated by the following formula, for example, based on the direct working hours.

$$Allocation\ rate = \frac{n1 - \text{month manufacturing overhead}}{1 - \text{month total direct working hours}}$$

(Unit: $ / hour. Allocation manufacturing overhead per hour)

$$\text{Allocation amount} =$$
$$= \text{Allocation rate x Direct work time required to manufacture the product}$$

Enter the date, allocation rate, and amount (allocation amount) in the manufacturing overhead column.

d) Product completion

When the product is completed, enter the actual amount and variance for each item in the summary column of the costing sheet.

Generally, the allocation system is not one, but some. And depending upon the allocation system, there are systems of Cost Calculation. One is (as above) Product Cost Calculation and, this company uses it.

Some other companies use Process costing rather than Product costing. And, Product costing is a calculation method used in cases of build to order, such as for machinery. Even, some company uses Active-based costing to analyze our costs lead to a reduction in overall cost. Thus, different variants can be found: Product costing, Process costing, Activity Based Costing, and Standard Cost Accounting

Above is the general information in SNS. Very good. And I will take the time to write the Process costing system and Standard cost in some opportunity. And in here, I write the Product costing which this company applies.

—Do you use this method for a quotation when making sales activities? —I asked the Accounting Manager

—Not really —He admitted—, because we don't use the full speck of the Product costing system, but just the part of direct material cost, direct labour cost, direct expense, manufacturing overhead cost record column for the reference of deciding sales price. Additionally, the data is standardized as the standard cost.

—My previous company —I replied—, and my division also used Standard Costing as Predetermined cost, Estimated cost, etc. And, as you understand Standard costing and Product costing are different. —And I continued— I believe your costing system is in between of both. Your Product costing is not a so-called Product costing and Standard costing system generally, but you standardize just above data as the standard cost. Am I right? …—everyone nodded slightly and then, I answered myself— Yes, it is.

—Now everyone, let's make a calm debate about "What is Cost". —And I detailed— Firstly, I recommend you to understand the (your saying) cost correctly to understand my first suggestion which is "To stop the policy of No receiving order in red".

—When deciding the decision of stopping outsourcing policy, I explained that it is recommendable to produce relevant products in-house, if there is the capacity to produce these items. And, at that time also one of the argument points was the cost. One of claiming was that in-house production is higher than outsourcing.

—But as you understand —I tried to explain—, if you have the capacity, the outsourcing of products is a bad decision. This argument is from the point of view of earning internal fixed costs. And this time, we look at the cost itself.

—Your saying is "Cost is too high" or "No cost competitiveness", but what is cost? —I asked and continued answered by myself—. Let us confirm the Cost. For instance, please imagine a retail business. The cost is just a purchase price. And, the comparison is simply purchasing price *vs* sales price. And the profit calculation is:

$$Profit = \sum \ [Purchase\ price \ - (Sales\ price - Fixed\ cost)]$$

—And it is very simple, but a manufacturing company is different and more complex. Generally, a manufacturing company sells the value through the products. And to create the Value, it is not simple to calculate it. Because, the calculation elements such as Fixed Cost (labour cost, staffs cost, depreciation etc.) are many —I continued…

—Generally, such cost is **allocated** to each product. And, above, production, labour cost and material cost are easy to allocate to relevant products as you know. But and on the other hand, staves' cost (office staff, engineers, sales staffs, managers…), depreciation (such as machine & equipment, building, etc) and, other fixed costs are allocated to the products in a rule…

—The allocation rule (for instance, my previous company) is depending upon the total production KMH (Kilo Man Hours: Standard Time). A company's allocation rule is the sales amount. A company allocates the fixed cost according to the headcount…

—However, it is strange. Because, for instance, the cost of Human Resources. It is strange to allocate the cost according to the sales amount which is affected depending upon the products and market. Then my telling is "Cost" which your saying is very uncertain. In such uncertain evaluation criteria, you are doing the steering the company.

—I believe –I tell the SalesManager—, you understand the outline of Product costing and allocation rule, are you? … You use something in between the Product costing and the Standard cost.

—Yes —Sales Manageradmitted—, maybe I could understand.

—It is not special—I tried to deep—, but there are many cases in some manufacturing companies, particularly build-to-order manufacturers, they use the Standard Cost for judging “Receiving order in red” or not. And the process is as next and, simplifying:

$$Product\ cost = Material\ cost + Labour\ cost + Manufactring\ expense$$

— Now here, it is necessary to present a particular concept and understand that the cost really is constituted by the WARP and the WEFT as if it were a FABRIC.. Thus, Costs of material, labour and, manufacturing expenses are likely WARP. On the other hand, it is necessary to understand the cost classification which I call cost of WEFTS which is the classification of Direct cost and Indirect cost.

—Material, Calling material has also both faces of direct and indirect. Labour cost and manufacturing expenses also have both faces. And the handling of these WEFT costs (direct and indirect costs) is different. And, I listened to some voices which tell us it is too difficult to classify these elements to Direct costs and Indirect costs.

As I write below, the Direct costs are easy to apply to the calculation. But the Indirect costs should be allocated depending on the allocation rule. Therefore, and if mistaking the classification, the results are very much uncertain.

—It is quite true —Accounting Manager agreed—. And I feel the necessity to have the management class to educate the costing. Particularly Sales and Production departments managers. By knowing the construction of costs related to profit, the policy, cost reduction, action plan and, sales plan are affected.

—Yes —I felt just a bitter smiling in my heart—. It is important to make education about the cost for not only all of the management classes but also supervisors and line leaders classes. This meaning is to educate a wide range of employees as wide as possible. Of course, it is necessary to consider the education about costs contents depending upon the classes. It is the meaning of that different menu is acceptable in management class and (for instance) line leader class.

—Anyway —I tried to wrap up—, today I and nuestro Accountan Manager would explain the cost jointly. And the purpose is to identify the reason for policy change about “No receiving order in red”.

Classification of costs.

As I wrote above, Product cost or, in other words, the Manufacturing Cost is the sum of the costs of Material, Labour, and Expenses. And each element is required to classify Direct or Indirect costs. Below is a table example of this classification.

Cost Classification		Material	Labour	Expense
		Cost of goods consumed to manufacture the product	Personel cost for employees involved in manufacturing such as direct work, indirect work, and back office.	Cost of Outside of Material & Labour
Direct	Clearly recognized ammount consumed for particular product.	Raw material and Purchased parts	Consumption wages for direct working hours in which direct workers to be involved in the manufacturing	Outsourcing Air, Gas, Water, Utility, Electricity.
Indirect	Unclear consumption for each product	Auxiliary material cost: Paints, dyes, fuel cost for manufacturing machinery, Factory consumable cost, the consumable cost in the production process, machine oil, consumable tools & fixtures, spare parts that are outside of fixed assets.	All other than the above are classified as indirect labour costs: Welfare, Bonus, Allowance, Provision for retirement benefits, etc. Wages for supervisors, line leaders, inspectors, material handlers, shipping or receiving clerks, maintenance technician.	Welfare facility, Rental, Insurance, Depreciation, Patent.

3. Production costs Calculation

Now, one of the difficulties to calculate Cost is that it is necessary to classify Direct and Indirect. Because, Indirect costs must be allocated to the product (or production line, factory) in the proper rule. And, the Production cost calculation procedure is as next in the case of my previous company and my division.

1) Accumulate Direct & Indirect Material cost

Direct material such as parts & raw materials: Predetermined material cost includes predetermined loss rate.

Indirect materials: Which the classification for each product to be unclear, shush as Machinery fuel, Paint, etc.

Predetermined (Estimated or Planned) cost.

In my previous company (Sumitomo Wring) and my division used (perhaps uses, so-called) Predetermined Costing system for the budget control and the evaluation of Factory performance. I will write this on other days. Anyway, the Factory performance review in the monthly management meeting was my biggest headache and the place of feeling small. Against, the Toyota division manager was full of strength because his division was profitable. And, I thought how exasperating it is!

The essentials of Predetermined material cost are:

- The specific name and part Number (which are decided & registered by the Design engineering and standardized). Based on this, accounting and purchasing departments decide and standardize below and the data is shared by relevant departments.
- Standard loss rate: It is based on past performance which includes the performance of similar parts & materials. And the formula is:

$$Standard\ Loss\ Rate\ = \left(\frac{Scrap}{Total}used\right) x\ 100$$

Re-use is not involved in scrap (disposal).

- Standardized purchasing price: purchasing price is changeable. And normally, the first price is registered.

Standardization of loss rate has a very difficult problem. And my previous division applied the Past performance principle and Irreversible principle. I write the argument of this company about these words and Loss Rate later.

2) Accumulate Labour cost; Direct & Indirect labour cost.

- **Direct labour cost:** Such as line workers' wages, bonus, retirement allowance.
- **Indirect labour cost:** Such as supervisors', (line team leader), inspectors, material handlers, maintenance technicians, shipping or receiving persons. Salary of a back-office worker.

Supervisors and line leaders cost to be Direct-Indirect costs.

In my previous company and my division, such people work for not just one product or production line, but some of them. A supervisor is like an assistant manager and supervises all production in one factory. (My previous division, there was one supervisor in one factory.)

Line leader naturally has plural lines and products. Therefore, his cost is necessary to allocate to these products.

Inspectors.

A products inspector also was Direct-Indirect worker. And, each production line has some kinds of products and inspectors (same inspectors) in the line.

A production line has product change depending upon the busy or slack of the business. And the working hours of each product were recorded in the daily report by manual. Now, of course, collecting data in computer terminals or barcode reading.

Another reason is to match the Predetermined (Estimated or Planned) costing system and Factory performance evaluation review.

I will write this Predetermined costing and factory management review meeting later. And, it is necessary to evaluate pure labour efficiency and direct-indirect cost separately.

3) Accumulation of Manufacturing expenses (Outside of material & labour costs);

Depreciation, Rental fee, Outsourcing expense, Loyalty, Air, water, gas, and electricity. Tools (Outside of depreciation), spare parts & inventory cost, Fuel, Oil & Lubricant, Welfare expense, Insurance, and others.

4) Accumulation of the direct cost (material, labour, and expense to be used or used).

I explain how the case of my previous company and division.

Direct labour cost is calculated as next:

$$Direct\ labour\ cost\ =\ Standard\ Hourly\ rate\ x\ Actual\ working\ hours$$

Standard Hourly rate:

$$Hourly\ rate\ =\ Total\ Manufacturing\ cost\ of\ past\ year\ \div\ Total\ working\ hours$$

Manufacturing cost:

$$Manf.Cost\ =\ Direct\ labour\ cost\ +\ Indirect\ labour\ cost\ +\ Manufacturing\ expenses$$

Total working hours:

$$Past\ year\ working\ hours\ and\ also,\ factory\ total\ or\ production\ line\ total.$$

5) Other Fixed cost calculations.

Again (from TPM-12[1]), the Fixed cost is:

Fixed cost:

Labour cost (Direct and Indirect), Head office, Depreciation of machine & equipment, land & building, payment of patent and interest and, etc.

In above, Head office, land & building, payment of patent and interest and, etc. These items are also allocated to the product cost. And the allocation rule is as above and decided by individual companies.

[1] TPM-12 Telework And 3 Major Misunderstanding: https://archive.org/details/tpm-12-telework-and-3-major-misunderstanding
TPM 12 Teletrabajo Y Los 3 Mayores Malentendidos: https://archive.org/details/tpm-12-teletrabajo-y-los-3-mayores-malentendidos

In the next lectures, I will introduce the Predetermined costing and factory review system of my previous company. And in the Basic Structure of Income Statement, I clarify then, the Cost deeply.

What is Cost? …Variable cost, Fixed cost, Direct cost, Indirect cost, Predetermined cost, Allocation, etc. And, Cost, Cost, Cost… We know that Cost is important for company management. However. It is indeed noisy and troublesome, but the knowledge of cost is essential.

The things which I want to tell you at this time are the next 4 items

1) The cost has many faces.
2) Therefore, it is risky to handle a company with just costs.
3) However, if the product has special superiority in the market, the cost-focused tactic can be succeeded.
4) But normally it is to seek the maximization of Marginal profit. (I didn't write it yet. But one of the final targets to describe Cost is this maximization of Marginal Profit).

4. Take a break in the loss rate argument

In this teaching company, there was an argument.

—Anyway—argued the Sales Manager—, I tell you, everyone, our sales price has no cost competitiveness and it is a quite true and serious issue. One of the causes is a high loss rate of main raw material. It is 13%!

—13% of loss rate —repeated the Sales Manager—. And, other materials also have so high loss rate. As you know, the percentage of parts & raw material in the product cost is more than 60%. Therefore, these very high loss rate affects to the high cost and the cost competitiveness.

—Wait a minute —interrupted the Production Manager—. We use the loss rate based on the standard which is: Past performance principal and the result of last year is fed back to the loss rate. This is our rule.

The Sales Manager replied then —I know the standard of Past performance principal. However, and when looking at the trend the loss rate of this main raw material, has fluctuated. And there was the term of cheaper. Why cannot you keep this lower rate? — asked finally the Sales Manager.

—I know the fluctuation —answered the Production Manager—. But the main cause of this fluctuation is the machine condition. Therefore, we discussed with President and decided to introduce Total Productive Maintenance which is included the Production Management, didn't we?

—Everyone. —And the Sales Manager asked— You don't understand the seriousness about the 13% of loss rate. At the last month, we made a sales promotion to a client about the new product which we intend the sales expansion and submitted the quotation. Unfortunately, the quotation was applied the 13% loss rate in the raw material. Initially, the person in charge showed his interest but soon made a wry face when he looked at the price. And he spoke: "Your offer is very interesting and I will contact other suppliers also".

—One week later —the Sales Manager continued his exposition—, we met him to gain his answer. But he had already decided to use another supplier. Yes, we lost the sales opportunity of this new product.

—Please don't let me say it over and over —begged the Production Manager—. Therefore, we established the project team and planned to introduce 8 pillars of Total Productive Maintenance. This is our top decision. Also based on the suggestion, we changed the Outsourcing policy and are improving labour efficiency. Additionally, as the result, the inventory turnover is becoming better. The cost reduction result is appearing. At now, the important thing is the sales expansion, isn't it?

With a disgusted face, the Accounting Manager participated in this augment and blocked the word of the Production Manager. Then, he spoke calmly —Yes, as he said, the profit/loss result is becoming better and we wait for the sales expansion. But anyway, it is quite true the loss rate is too high. Sometimes the raw material shows a 23% of loss result in a week and it has fluctuated.

—Unfortunately —The Account Manager continued—, our cost is still unusual and too high. One of the reasons is this loss ratio. If the appropriate loss rate is 3%, 13% loss rate pushes up the cost more than 6%. And once time you achieved the loss rate of 3%.

—As you insist —The Production Manager answered—, it is quite true P/L is becoming better particularly in labour efficiency, relatively fixed cost, and inventory turnover. However, will you please never forget that more than 60% of the total cost is material? The current loss rate affects the cost competitiveness is quite clear.

The Production Manager continued his argumentation more deeply and then he expressed in this way —We are introducing Total Productive Maintenance. Then we could be able to recover the cost in the material cost also.

Sowing a worried face the Accounting Manager asked —But how? We should omit Total Productive Maintenance which seems to show the direction, but does not suggest the method. Sensei, please advise us. What is your opinion?

During their argument, I was recording in my notebook, and I said—Sorry I'm busy taking notes and I don't have time to join your useless argument. Please continue your barren debate. So, probably, my English level is still poor and I cannot follow your argument. But this memorandum is useful when teaching other clients. I will introduce this argument as one example of the barren & waste argument. Then, please continue.

All directors continued their arguments ad then the Accounting Manager spoke —We wish your advice about the cost reduction. I think the talking of the Sales Manager is correct. We understand and appreciate your precise suggestion for instance outsourcing policy change, project leading and TPM introduction with QC Circle, etc. Now we need your advice regarding the cost reduction.

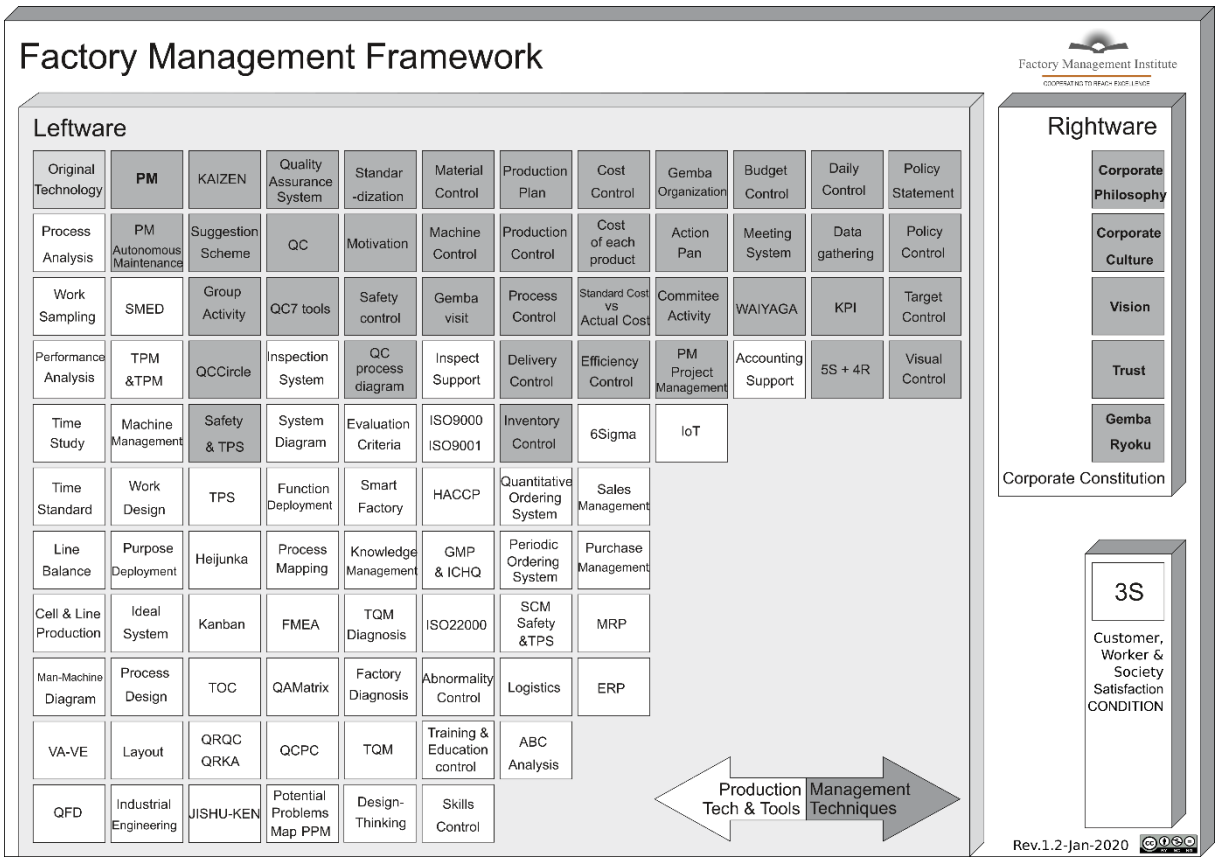
—I appreciate the evaluation of the Accounting Manager —I said—. But please allow me to tell you about **FOUR reasons** to stop this repeated barren argument…

1) Total Productive Maintenance is not the answer to your desire

—**First one is:** Total Productive Maintenance is not the answer to your desire. Is it your desire for Cost Reduction & Profit Recovery, isn't it? ...Firstly, please understand that our contract isn't the cost reduction issue, but just about TPM introduction.

—I said that there is no meaning the introduction of Total Productive Maintenance, even if it is called Total Productive Management, for cost reduction, which is an ultimate purpose of a company…

—As the Accounting Manager expressed, Total Productive Maintenance intends to improve factory management from the point of view of machine & equipment. However, if you wish both the cost reduction and profit recovery, then it is necessary to act from the points of multifaced views which is the Factory Management Frame.



2) High-cost Constitution

—**The second one** is you have a High-cost constitution…

—When investigating your company and according to the survey of the project team, it is quite clear that your company is very high-cost constitution as I pointed out. There are problems in Product Quality, Production Planning, ***Muda*** of fixed cost (Labour capacity, machine & equipment depreciation), etc —I continued…

—It is quite true that there are ***Mudas*** in the machine caused by poor PM (Preventive Maintenance). And it causes the ***Choko-Tei***: (Impediment of "JIT of Machine Condition" described into TPM-10[2]),

[2] TPM 10 Employee Engagement & Oil Control (ENG):
https://archive.org/details/tpm10employeeengagementoilcontrol
TPM 10 El Compromiso Del Trabajador Y El Control De La Lubricación (ESP):
https://archive.org/details/tpm10elcompromisodeltrabajadoryelcontroldelalubricacion

frequent production plan change, unnecessary timing production (for workers to be free), over-inventory, and long LT, Change-over loss, Labour performance down…

—The poor production planning allows causes very large production lot size, Muda of overproduction, obsolescence, disposal loss, disturbance to JIT, long lead time, over-inventory. These are not related to TPM even though it is Total Productive Management. And, it is quite natural when occurring a problem, to **investigate scientifically**…

Then I changed my speech some more related to the Manager's debate —Why do you make such barren debates repeatedly? …The data by the project team shows that another biggest cause of high cost is quality. It is caused by the double inspection before shipping, re-work for repair, and re-production with using materials and disposal by a defect. Thus, when looking from machinery, the Pareto Chart shows that the biggest problem is not machine precision, but setup mistakes and material misused (and these ***Mudas*** are accelerated by big lot size)…

—You have explained the effect of Total Productive Maintenance with good examples like an omnipotent tool. It is stupid —I concluded.

3) Process of "Total"

—**The third one** is the word TOTAL. So, Total Productive Maintenance!? …Are you telling me a joke? …What meaning do you have in current corporate capacity which not having a basic factory management base to challenge this Total Productive? …I'm teaching Total "Preventive" Maintenance. And, it also requires the step to introduce in a poor level base of factory management, such as your company. The essential elements are:

a) PM implementation by the maintenance department;
b) Maintenance technician education & training;
c) Data gathering and recording system and the use. In parallel;
d) Gemba committee activity (5Ss, Kaizen and, QC Circle & Group activity);
e) Operator education & training & system of evaluation. And;
f) Management team development, data gathering (KPIs) & the use.

—Then, it is possible to transfer from PM (which is just by maintenance department) to companywide activity.

4) There is no tower on the sand.

—**The Fourth one** is you cannot build a tower on the sand. I tell you, many factories succeeded to improve with the companywide activity. But please understand that these companies had a certain level of factory management foundations and based on these, challenging next step with additional companywide activity from the (for instance) point of machine & equipment. Some books introduce the effects of Total "Productive" Maintenance. But these books give a fade image of companywide activity for "Total"…

—Then, I clearly tell you that, other companies who succeed to improve are not with just Total Productive maintenance, but by the synergistic effect of the base and the new introduction. And, they had a certain level of factory management base…

—Well, —I conclude, and then I spoke to the Accounting Manager—, I suggest one of a good idea about cost reduction.

—Simple. It is a very simple idea. And, it is to dismiss me —and I continued looking at some surprising faces—. As you know, I'm very expensive. My consulting charge is very expensive. Nevertheless, quite often I'm forced to make some kind of a waste of time. These barren debates don't need me….

—Another suggestion is to improve the meeting quality as a management team. Please excuse me, I need to attend the project team meeting which is a very high-quality meeting indeed. Because:

a) Pre-planned date and time.
b) Pre-informed theme.
c) Pre-data & information sharing.

—Simple and easy. They (project members) share these before the meeting. Relatively, your meeting. There are the first and the second points, but missing the third. —And I concluded— Sorry, I leave to attend another more useful meeting.

Then three days later, the Accounting Manager visited my hotel and gave me a paper. And, in the paper, there were 3 materials which were the invitation of the meeting (date & duration and theme; Cost Reduction), attendees, and material (Pre-data & information sharing).

But when looking at the papers, I was tired of many pages of the papers. And I told him —Sorry. I will not be able to attend this meeting, because I need to read this material. But unfortunately, I need one month of lead time to read this paper using my poor English.

—Sensei this meeting is very important as you understand. Therefore, we desire your participation by all means. —The Accounting Manager asked— Shall I explain one by one?

—No —I answered—. And I don't want. In the first place, why do you need such thick documents? …Do you intend to explain the contents of such enormous documents?

—No, Sensei. Not all. But somebody wishes to know the verification of data.

—It is good —I said him—. However, please finish such a ritual before the meeting if it is necessary. Where is the conclusion of these enormous materials? …Please summarize in one or 2 pages and share these also before the meeting. Would you like to talk a little in the hotel bar?

Then we sat down in a booth of the bar and ordered 2 glasses of whiskey. Probably, he was tired a little and soon got drunk a little and talkative. Thus, according to his talking, the management team got very strong pressure from the President regarding the profit recovery. In this way, the president requires from the managers an urgent recovery plan.

But, why urgent is required? … To answer this question let us see the background.

5. Profit recovery plan

This company failed to make a profit recovery plan and its implementation once time.

Initially, this company intended the profit recovery by introducing Total "Productive" Maintenance which was suggested by a friend consultant of the president. And, the initial project was spent more than half a year, but this company understood that it is too difficult to introduce by themselves. And after they lost half a year, they invited me. And I started my teaching, but it wasn't Total "Productive" Maintenance, but Total "Preventive" Maintenance.

There were discrepancies in thought between my teaching and the president's and also between the managers. And tthese discrepancies were:

- My teaching is Total Preventive Maintenance.
- I and some directors thought is TPM is not a sufficient answer for cost reduction.
- The President's thought is Total "Productive" Management and which is almighty.
- Few directors wish to think and follow the president though.

I understood that this (to resolve the discrepancy) is just the thing it is a barren effort.

Anyway, I taught the next items for the future of this company:

1) PM (Preventive Maintenance) introduction and stability; Countermeasures for Choko-Tei and "JIT Machine Condition".
2) Gemba Committee introduction (QC Circle, Group activity, 5Ss); Formulation of "All people's participation" and ***Kaizen*** mind. The base of "Total" Gemba people involved.
3) Management Team establishment (organization): For the establishment of "Total" which Management involved.
4) System establishment; KPIs data gathering & record system and the utilization.

When teaching and introducing such "Total" (TQM, TPM, TPS, etc.) which is required the companywide activity in a company, I call "*trinity essentials*", which are **Gemba people participation**, **Management organization**, and **Management system**. (which are above 2, 3 & 4) is required. And without such background (such as this company), it is like a Tower on the sand.

Back to the conversation with the Accounting Manager.

—I believe we could find the corrective way to the profit recovery by your teaching —he said.

—We have the time limit and it is getting closer because we waste the time (half years) already. Our president wishes to make his decision soon which is the factory scale reduction. And we desire to avoid the scale reduction of factory space, labour capacity and, machine capacity (relevant business scale reduction).

—Simon —which was the name of this Accounting Manager—. Let's drink and calm the mind. How is your family? …When I was invited to your home, I met your sons and a daughter. Your daughter is the same as my grandson. It is a good thing if they could communicate with each other near future.

I tried to relax his mind before a serious conversation using an idle talking and after that I said —I knew the situation of your factory and therefore I suggested the outsourcing policy change as an emergency action. I know such a matter is not involved in our consultancy contract. But, as the next suggestion, I recommend you to stop or change the prohibition policy of "Receiving order in red".

—I accept your meeting invitation. —Then I detailed— but there are some conditions. And, no, it is not so difficult and is a natural thing. And, it is one of meeting training. So, the condition is to follow SUMITOMO meeting rule.

III. SUMITOMO meting rule: One-page rule

1) One page best, two pages better, and 3 pages worse. My previous company has the **one-page** (report) **rule**;
2) Data & information sharing (at least) 3 days before. Of course, it is required to read this and to be understood;
3) Gathering everybody before 5 minutes to start and, to keep the duration;
4) Every attendee takes part (to make an opinion);
5) To draw a conclusion.

By the way and, about this **One-page rule**, there is a story:

When I was in the UK, I attended a big conference which was a joint meeting with SUMITOMO and a UK famous company who produced wiring harnesses and supplied to (for instance) Land ROVER to establish a new joint venture company. Now this company is 100% SUMITOMO and name is Sumitomo Electric Wiring Systems (Europe) Inc.

The attendees from Sumitomo were Mr. K. Kobayasi (Senior Managing Director), Mr. Y. Yamaguchi (Managing Director; my boss), Mr. M. Iwaoka (Sales manager) and, me (Special Project manager residence in Lucas SEI).

When took a seat at a large meeting table, we found a huge number of papers which were like as 2 thick books. No, it is an exaggerated expression to say, actually, about 15mm each of 2 A4 size books.

When the chair parson (Managing Director of Lucas side) wanted to start the meeting, Yamaguchi stopped the opening declaration and spoke: —Wait, wait. Please stop the meeting start. What is this huge number of papers!?...

—Please, everyone hold on —and he broke the cover page and picked up it and waving it and said—. We Sumitomo Top Management decide by just one paper. It is just one paper. Do you require us to read such a huge number of papers now? …Impossible! Please re-schedule this conference urgently. Of course —he concluded—, the necessary paper is just one page —And then they went back to the hotel.

They (UK side) turned pale and we urgently made the discussion. And, I suggested the Sumitomo one-page rule which is rational thought.

One-page rule: What are the necessary figures to make a decision? …If it is necessary to explain the background, a second page is prepared.

The second page (DN-A2 or DIN-A3 size) is described with a relation diagram that uses data tables, graphs, pictures & photos, and short sentences.

They were greatly perplexed and asked me the countermeasures because it might be impossible to open the conference. It is quite clear to be impossible to prepare the second-page relation diagram.

Then I suggested the temporal paper preparation as next:

- Summary sheet (necessary data and explanation to make a decision.)
- Paper reduction (Shave off the unnecessary data to make a decision.)
- Numbering in necessary explanation in the paper and
- Putting tags in the papers.

During Japanese visitors and UK top people went to a dinner party, mainly accounting people were preparing papers. I was attending the party, but in the middle, I was called out and went to a separate room of the party venue. And we checked the preparation.

Then, the conference was made with no mishap.

I asked him to consolidate & summarize in one page. And, I explained (maybe again) the SUMITOMO meeting rule as above. And I told him —It is no meaning to see the detailed accounting data, but I want to know the current situation with concluded data.

—It is simple —answered the Accounting Manager—. On this page, there is the data that shows the current (6 months Trend of) sales amount and P/L.

—What are the essential items for the profit recovery? —I asked actually, figuratively because I wanted to answer to myself—. Sales amount increase. Yes? …But it might not be expectable in the current sales price as the sales department says no cost competitiveness.

—Please —I asked him—, let me know how the seriousness of the P/L is. Is it an urgent situation? …Do we need additional emergency hemostasis?

—It is a serious level because the president needs to decide on business reduction within some months. Then we were required to make up a recovery & survival plan immediately.

—I said as the Emergency hemostasis and you changed the outsourcing policy, and switched to in-house production. But the expression of “Emergency Haemostasis” is not proper, but is a very natural act when considering the total cost. So —I used his name to call his attention—, Simon. The facts are:

1) It is necessary to increase of Sales amount. And,
2) Customers are depending upon the price. But,
3) There is no cost competitiveness for sales.

—Now please —I beg Simon—, discuss with sales department the product can be sold in how much in 3 ideas. These are Optimistic price, Pessimistic and Maximum possible price. And, based on these, Please calculate the total cost and P/L….

—Perhaps, it is possible to find the solution. But the important point is to abandon the policy of “Prohibit the receiving order in red”.

And —I continued—, firstly, You both Accounting Manager and Sales Manager discuss the 3 ideas of the main products including sales promotion products of sales department’s wish and 3 ideas of each product were decided. And, based on these, the accounting department calculated the P/L.

Thus, based on the data the management team meeting was held, I was invited. But to be continued on next time. Then I will describe the next two points:

1) A policy change of “Prohibit the receiving order in red”.
2) Establishing the tag-team of Engineering and Sales.

IV. Relation Diagram

I will not take up New QC 7 Tools in the next lecture TQM except Matrix Data analysis which uses numerical data. Therefore, it will be a little longer, but I will explain this one of the NQC 7-tools outlines.

I explained the One-page rule (one page best, 2 pages better, and more than 3 pages worse). And if it is necessary to explain, it is accepted to attach a second page. Unfortunately, when looking at the planning paper (of my previous division), there were not the best, but here I explain the second page by using a Relation Diagram[3].

I wish to explain that my method and so-called Relation Diagram (Interrelationship Diagram) in New QC 7 Tools is a little different. And my Relation Diagram uses not only the next text information, but also numerical data, data table (simple), picture, photo, and other visual information.

Firstly, the **matching points** of my point of view and, the NQC 7-tools Interrelationship Diagram are:

1) Bird's eye view (of the whole)
2) To appeal to the eyes.
3) To be able to see the relationship at glance.

Not matching points are:

4) Any visual information. This NQC tool is used just for text information. But, my diagram uses not only text information, but all visual information simplified such as pictures, photos, data-table. (To use not only Left but also Right Brain);
5) To use as one of idea creation methods (like as KJ method);
   In fact, there is no description in the material of UJSE (Union of Japanese Science and Engineers; An authoritative organization for quality control), but there is in some QC textbooks. And, there is no such description (which it is used as one of idea creation method) in English web site.

Here I introduce the orthodox explanation of the Relation Diagram in the site of New QC 7 Tools as next and according to a QC site, it is explained as next:

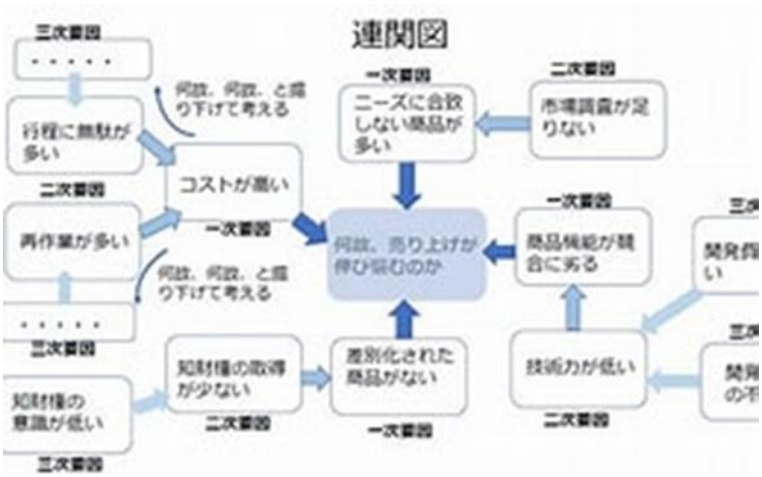
> *Relation Diagram (which is One of the seven new QC tools) is, in a nutshell, a method of "clarifying the interrelationships of various information, problems, events, etc."*
>
> *A method of clarifying problems by diagramming the causal relationship between a specific result and the various causes that caused it. And, This is a method of trying to identify the factors to be solved from the further visualization of the interrelationship between the extracted and organized groups of information. In other words, it can be said that it is a method that can be a support tool for solving problems by logically clarifying the causal relationships that are intertwined with each other, such as a cause and effect diagram, purpose and, means, from various information.*

[3] **Relation Diagram** is reknow also as Affinity Diagram , **KJ-Method** or **Team Kawakita Jiro** (TKJ) and, It should not confuse with Entity–relationship model or diagram, using in the IT-Database designing:
https://en.wikipedia.org/wiki/Affinity_diagram
ESP - Diagrama de Afinidad, También se denomina **Método KJ** o **Team Kawakita Jiro** (TKJ) :
https://es.wikipedia.org/wiki/Diagrama_de_afinidad .

For example, suppose your company's sales are sluggish and not up. As shown in the example in the figure, write down the factors that are hindering sales, and connect each with an arrow along with the causal relationship.

It is expected that the causal relationship between various factors will be clarified, which will lead to the narrowing down of issues to be dealt with.

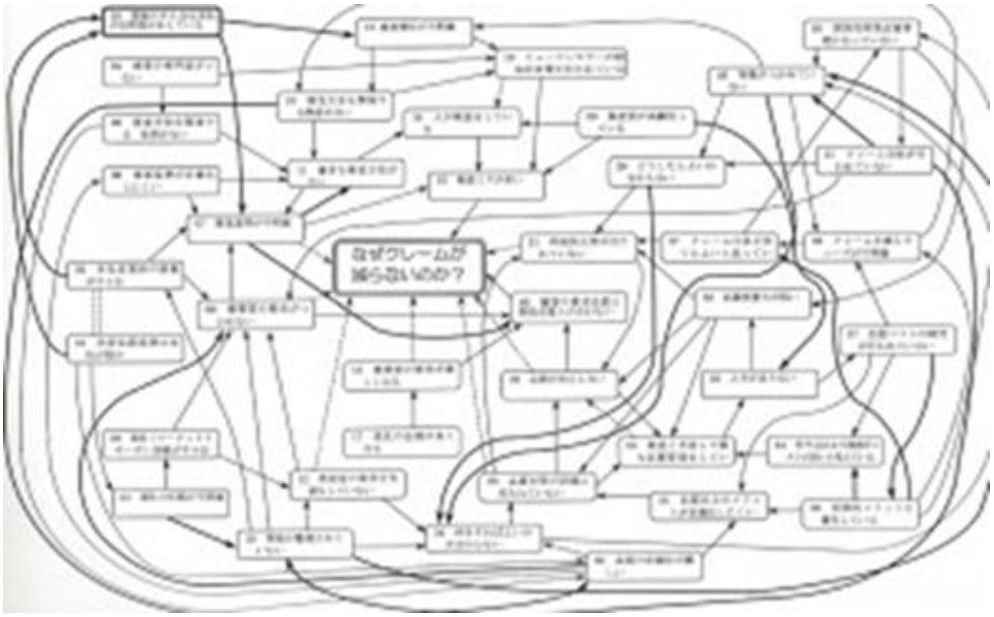
<u>Theme;</u> Sales are sluggish and not up.



As you see above example, the information is just text information only. Thus, QC 7 Tools are used mainly statistical numerical data. Although, the exception is Fish Bone Diagram and Check sheet. But these numerical base tools are sometimes difficult to use in the indirect Gemba such as sales, office, etc. Then, it is required to analyze the phenomenon with abstract words. In fact, there are some needs of analyzing phenomena with words and not numerical data in direct Gemba. And, I recommend using the KJ method in such cases.

The image of my Relation Diagram doesn't fuss over just abstract text information but uses any visual information.

I show a bad example above. Thus, please receive my apology. (From the Web site of NQC7tools) Please look at the next example (Also, Japanese text).



Who (including the interested party) can understand this? I think everyone falls into stop thinking and the disliked feeling (unless the person who likes puzzles). Indeed, is this useful? …Now let's think about what is the purpose of this complicated diagram:

1) The purpose is to understand the relationship of event, phenomenon, or matter. However, for just understanding these, it is not necessary to use the diagram spatially arranged (in a big white paper or whiteboard).
2) It may useful for ***Seiri*** of thinking by making this.
   But this example may difficult to expect the reproductivity thinking by even the person who made it (unless the person who has the capacity of more than 130 IQ). Then, sometimes I call such a complicated chart the masturbation (sorry) selfish article.
   It is a bad habit that the interested party seeks self-satisfaction and self-appeal by making complicated (many texts information) charts.
3) The important purpose is to understand the relation "At a glance".
   Why at glance? Easily understanding? Yes. But moreover.

Understanding is not only an effort by the Left-brain hemisphere but also the Right-Brain Inspiration.

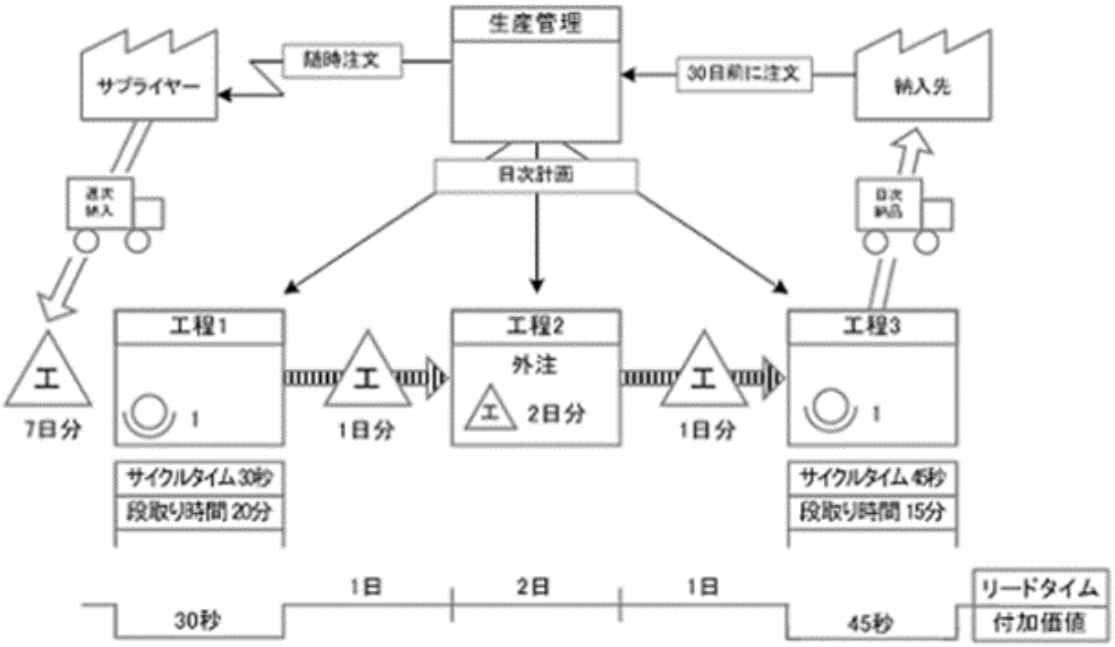
Why Right-Brain also? …This tool expects not only the information ***Seiri*** but also to discover the new idea in a visual diagram.

A famous manager said the final decision is made by inspiration after the consideration of numerical data and scientific analysis. And, sometimes the inspiration denies the direction which is shown by such numerical & scientific data collected.

Therefore, I recommend using the visual and spatial arrangement diagram such KJ-Method, Flow Chart of Things and Information etc. And, one of the important factors to make is to be simple and understandable at glance. For instance, Flow Chart of Things and Information.

Probably, you are much familiar with the name of so-called VSM (Value Stream Mapping).

For instance:



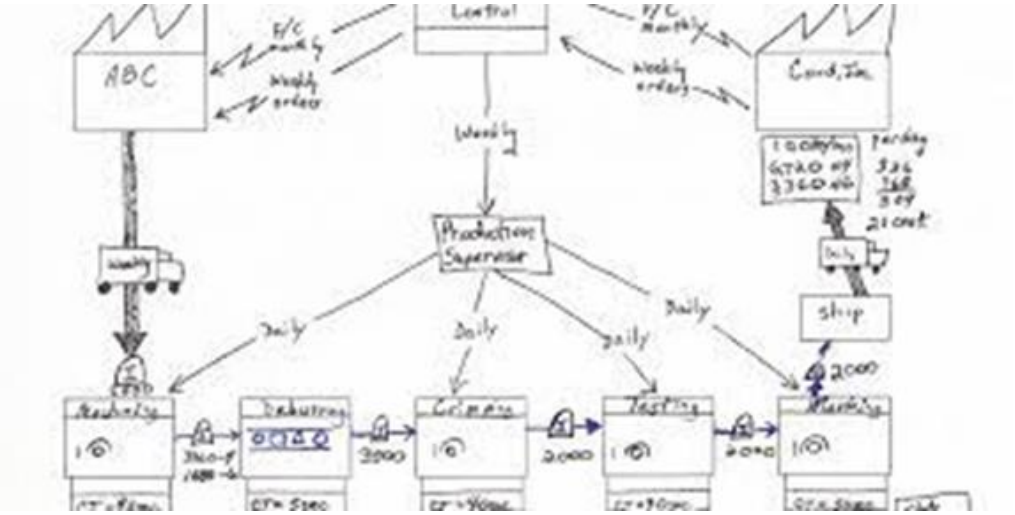
My apologies, again for the above Japanese example. I will explain VSM another day. But now and shortly: This figure shows the route of the entire process from the processing of raw materials to the delivery of a specific product (product family) to the customer, and where each process is performed according to the instructions.

When drawing, not only the process to be improved but also everything from the primary supplier to the delivery destination (customer) is arranged from left to right in the order of the process so that the connection before and after can be understood.

The process is represented in a box shape, and the process name, its operating time, and the production lead time are added.

Then, the information source of the pick-up and the mechanism of the instructions for those processes are shown, and at the same time, the information transmission means and the frequency are described.

VSM is never a special technique but must be used conveniently in a (for instance) Gemba meeting.



My team also used it in an instant meeting. And after this, it was attached as the formal second paper for a making decision meeting if necessary.

I said that I will not take up the NQC7Tools (except Matrix data analysis) in the next lecture about TQM. And, instead of teaching these, I would take up KJ-Method again. Because it can be used moreover easily as the replacements of Affinity diagram, Relation diagram, Tree diagram, Matrix diagram, Process decision program chart (PDPC) and Arrow diagram. For instance, I use KJ for FMEA, FTA (Fault Tree Analysis), and Fish Bone Diagram.

Although, Why KJ? …When looking at the process of Affinity diagram, Relation diagram, Tree diagram, Matrix diagram, Process decision program chart (PDPC), Arrow diagram FMEA, FTA, etc, the difficult process is to create every individual element. And, after creating these elements, the second hurdle is then, sorting them (in for instance Cause and Effect). KJ which is played by several diverse persons such processes in WAIGAYA and creates cards. I teach, then, KJ-Method as the first lesson.

The above photo is a scenario of KJ-Method teaching. And, the theme is “What is Kaizen” and it is required to find solutions by themselves.

In this regard, I don’t teach solutions, but require to find them by students. I call this Classroom “not to teach”.

I already wrote about KJ-Method. But, I will write it a little modified in the next description about TQM again. I explained the SUMITOMO meeting rule and “one-page rule”. And, the story has jumped to KJ. Let's finish it here. For now

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V. Oil control-4.

Why TPM? …And, What is its purpose? … To explain this matter I rather prefer to tell a story…

1. A story about TPM

Long years ago, I have visited a small-town factory. Which was operated by 7 employees, the owner president, and his wife. In total 9, moreover my 4 students.

After looking around the factory, we sat down in the Gemba office and were served coffee by the senior managing director (the president's wife).

After several chats, my students made very impolite & rude but quite straight questions to the old president. It was like an interview with him.

1) TPM deployment.

One student told him —Why don't you clean the factory a little more? —And also asked— why don't you renew machines? …These are too old looks like. The reputation is ruined, despite the good and famous products. How old are these machines? …

—I introduce you to a good teacher, Mr. Kimura— He told him in the meantime I listened to the conversation with breaking out in a cold sweat—. And, I recommend you to learn 5Ss and TPM.

—TPM? —The President asked surprisingly—. What is this?

—Mr. Kimura is a specialist of TPM —answered the student, when also he deeply explained more and more about my expertise. But actually, one of my young friends explained the outline of TPM. And I was listening calmly to the conversation of rude but pure students and the old & veteran top management. With smiling and feeling a little funny. Because their feeling and mine were completely the opposite. And, for instance, I felt admiration for the good maintenance of the machines.

—And —douted the president—. What is the purpose of TPM?

—Well, its purpose is to maintain the performance at any time when it is necessary to use. When looking at an old machine, wires are used in some places. And, I thought that PM (Preventive Maintenance) is not sufficient —said the student—. You are producing admirable products. And I recommend you implement proper PM.

—Tanaka-san —I rather prefer to use the name of the president—. How old is that machine? …It seems to be quite old.

—That's a machine and the other 2 out of a total of 9 machines come from my predecessor and they are more than 70 years old. —describes the president—. Therefore, there are no spare parts and, it is necessary to make parts when broken. However, they are still active and making a very good job.

This factory was indeed old and dingy. No 5Ss, but normal ***Katazuke*** level. However, the machines were well maintained (good machine 5Ss and oiling).

Good machine 5Ss? …Even though using wires in the parts? …The wires were the hand-made alternative parts. And, I learned his philosophy. Which were: "*Machines are important partners which have their own life*". The purpose of maintenance is the health of the partners and extend the life.

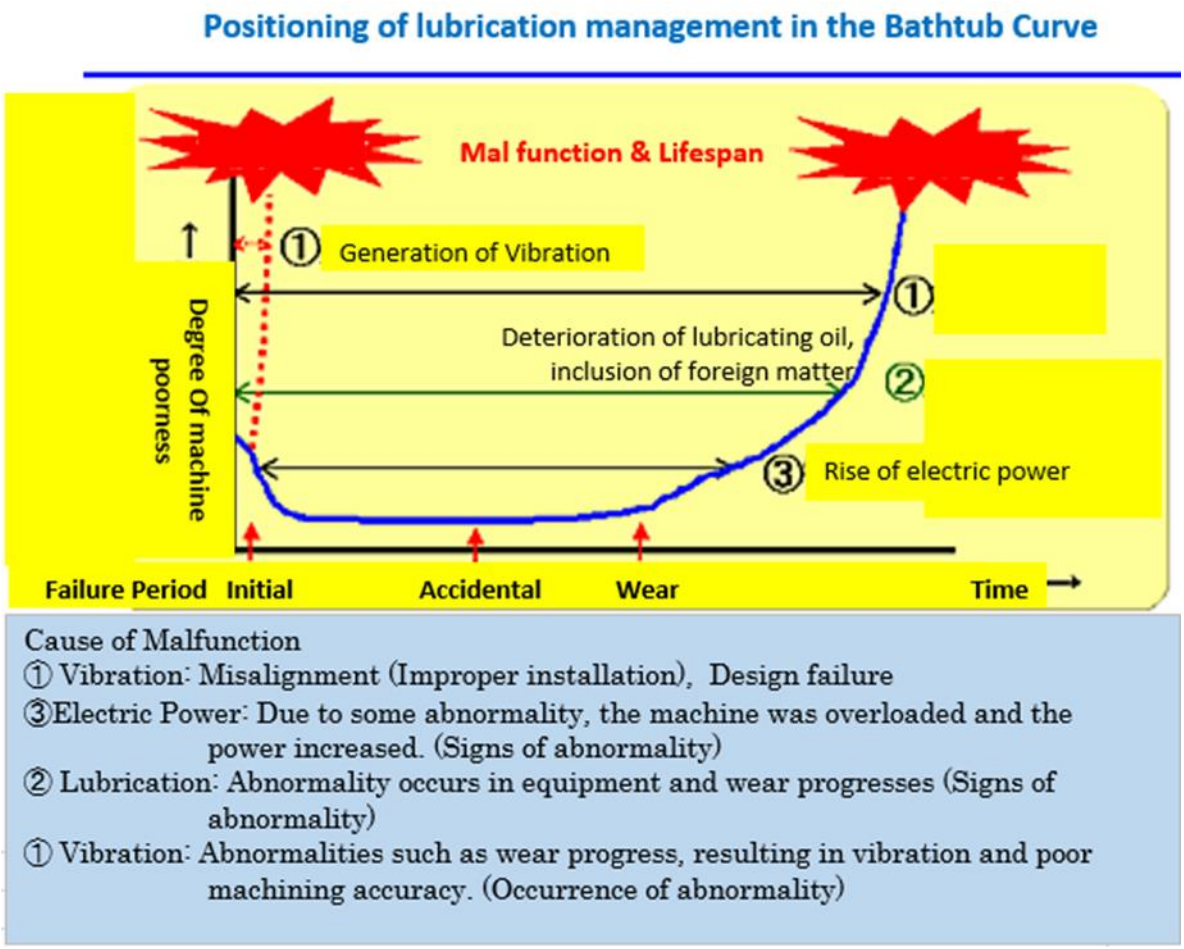
Thus, comparing to my philosophy. Why TPM? …To seek the "JIT machine condition". (It is possible to use "necessary machine at any time in the necessary performance").

Again, I learned from his philosophy and like it. However, I know that probably his admirable machine philosophy isn't accepted in Europa & the US (also it wasn't by my young students). But I like it.

Now in here a little detour.

I point out one contradiction in my past description. In the Making Stream of Production[4] and somewhere else, I wrote that a machine doesn't take age, because it is possible to replace the parts worn out. Therefore, a machine doesn't take an age. (The word of my old Toyota friend retired)

On the other hand, I have explained the Bathtub curve:



[4] Making the Stream of Production:
https://archive.org/details/makingstreamofproduction13_202001
Establecer la corriente de producción:
https://archive.org/details/establecerlacorrientedeproduccion13_202001

This bathtub curve shows the machine's lifetime and the limit. However, Mr. Tanaka's and, old Toyota person's though are different. Their thought is: "A machine doesn't take age".

Do you remember the next photo?

This is the photo of an active textile factory (At 2021) that uses several Toyoda Jidou-Shokki (G type Toyoda Automatic Loon, 1924, by Toyoda Sakichi). For almost, 100 years, these machines are active. Of course, the functions of Automatic stop, safety system, etc. are still active.

When looking at these facts, we need to reconsider the lifetime of the machine. There is no eternal object. Therefore, a machine also has a limited lifetime.

However, the image of machine life is not the Bathtub curve shown.

The lifetime assumed is the timing of the maintenance cost to be higher than buying a new machine.

2) Meeting for the conclusion of this visit.

It is usual to make a meeting to conclude the visit. And, we asked this company to use the Gemba conference room as usual. In this way, I reproduce the conversation with my young students.

—Sensei —he pointed out—. Sensei admired this factory and the owner president. But we don't understand what points are admirable. Because the factory is old, dirty and, dingy. The machines are also too old. Moreover, there are no young generation employees, and the employees are old age.

—We couldn't find good points —He continued—. No, there is one excellent point. It is the products of craftsmanship which are famous in the world.

—You understand the good points. Probably —I answered—, that's skill cannot be replaced by AI & RPA (Robotic Process Automation), even if these are improved more. So, craftsman skill. Creating new products by using the traditional craftsman skill is excellent. Also, this company earns a constant profit and creates & keep employment opportunity. Moreover, the employees are all looks happy which is possible to say good Employee Engagement or good motivation.

—Although from now—I pointed out breaking the argument—, please use the time for 2 things. The First one is the conclusion of this visit. The Second one is making recommendations.

4 hours later. They made the conclusions and some recommendations. And, they made the presentation to all employees including Mr. and Mrs. President.

These were very frank, even though, sometimes rude but also give fresh sensation. These were:

a) We came to study TPM. But unfortunately, we couldn't find good points about this theme. Because the factory is dirty and dingy (sorry for this comment, even all attendees accepted this comment with laughing.)
b) There is one mystery why you can create admirable products which have overwhelming competitiveness in the world.

—We believe —students continued—, that you have a secret to creating ideas. Because, be had learned that the secret is good environment such as flowers, planting, sound lighting, pictures, etc. such stimulating Right-Brain which takes charge of a flash of inspiration and ideas.

—Secret!? …Secret to create ideas? …Well —President doubted and he said—, It might be Toilet. I conceived the idea in the toilet.

—I'm really annoying —the Senior Manager, his wife pointed out—. Because his using of the toilet is too long and sometimes it is more than 1 and half hours. Someday when I opened the door, he sat down on the toilet stool and looks like thinking. Since no way, I went to the nearest convenience store to borrow a toilet. Really, really, it is annoying.

At this moment everyone said —Toilet!?... —And they burst into a laugh.

—What are you doing in the toilet? —Senior Manager asked the President.

—Thinking —President replied—. The toilet is very good, no, the best place to make thinking in meditation. My toilet has the best condition for think in meditation which there are flowers, beautiful photos, smell, narrow space, calm, dim, and, more than anything, the feeling of release after finishing.

At this moment everyone burst into a laugh again.

Now please, Let me omit the presentation and conclusion speech and going directly to the conclusions.

—We understand —Student continued—, and learned the admirable points of this factory. However, we have one suggestion for the future of this factory.

3) Factory beautification.

—Our suggestion is the beautification of the factory —The student pointed out and continued detailing...

—We understand that motivation (Employees Engagement) and teamwork are good and have no problem. But, You (everyone) need to consider bringing up next-generation which must be your duty. The key point is the appearance (visual aspect). Sorry. But…

—Your factory is dark and dirty, which are not related to your excellent motivation and products, but is affected to the hire new employee, and, obviously, hiring young generation…

—Your machine maintenance is excellent (evaluated by our teacher). But, why you don't maintain the working environment as same as machines? …We understand that it is very much troublesome…

—It is required to maintain broken window glass & and brush, to take off unnecessary objects from factory space, deciding the locations for the objects usually used, particularly oil station, please better & necessary lighting, flowers, plantings.

4) Public relations

The purpose of Public Relations is to maintain good public relations with people and society.

—What are your corporate philosophy and yearly policy? —He asked the president—. We believe you have it. We understand the toilet thinking. But it is necessary to bring up the next generation (young generation). Then we recommend you to implement some things, which are to show the corporate philosophy, employees group pictures, the pictures of products transition, prises, pictures of old machine origin (very old but still active duty).

The Student ended up his speech giving thanks to every attendant for their teaching and listening. And, after went back to class, we continued the discussion.

5) TPM and Efficiency

2 points, which were TPM, and what Efficiency is.

a) TPM

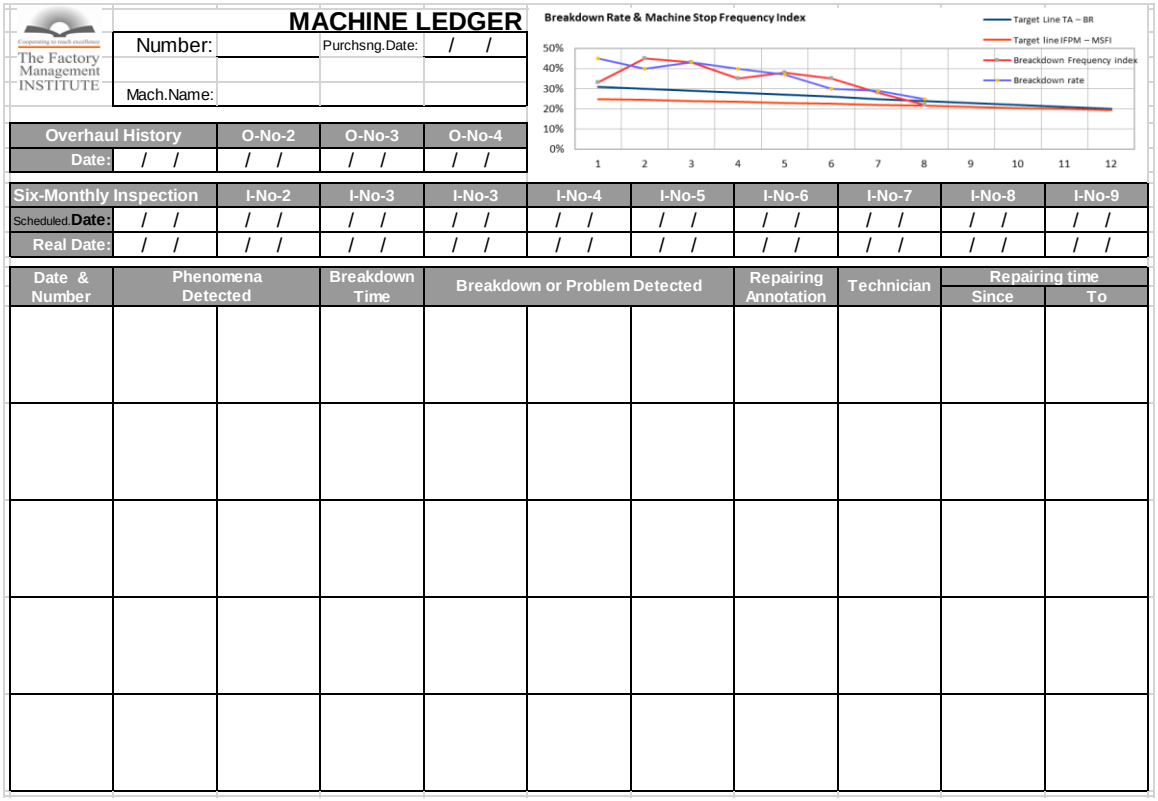
Regarding TPM (Total Preventive Maintenance) and about the condition of TPM and the situation of this factory:

- **Total:** This company implements machine maintenance by all employees. It is excellent.
- **PM (Preventive Maintenance):** No checklists, no schedule, no standard & one's own way maintenance.

On the other hand, Daily oiling, touching & polishing & listening to the voice of the machine and well understanding, and, there were 3 recommendations by students which were:

1) Sharing bits of knowledge among the employees (to learn and to avoid one's own way maintenance);
2) Regular physical check-ups and Medical Charts on Computer for each machine;
3) Oil control.

This young group helped and made the Medical Charts on Computer impromptu.



MACHINE LEDGER

The Factory Management INSTITUTE

Number: Purchsng.Date: / /

Mach.Name:

Overhaul History	O-No-2	O-No-3	O-No-4
Date: / /	/ /	/ /	/ /

Six-Monthly Inspection	I-No-2	I-No-3	I-No-3	I-No-4	I-No-5	I-No-6	I-No-7	I-No-8	I-No-9
Scheduled Date: / /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
Real Date: / /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /

Date & Number	Phenomena Detected		Breakdown Time	Breakdown or Problem Detected			Repairing Annotation	Technician	Repairing time	
									Since	To

Above is the recommendable form of Medical Charts. But the students modified these more, and more simplified charts.

And, another idea also was accepted by this factory. Which was the Sharing knowledge among the employees. This is useful not only to learn and to avoid one's own way but also, to share the senses (judgment of noise, smell, vibration, scar or surface-roughness, sliding).

Now is the turn to explain the necessity of TPM.

TPM which is systematic machine maintenance activity is necessary for relatively large and complex machines and/or for the factory which has many machines even though relatively small & simple machines. On the other hand, this factory has relatively small and not so complex machines. It is not the absolute condition to implement TPM in such a small factory. But it is necessary to keep such above condition (daily oiling, etc.).

b) What machine efficiency is.

The best condition is to realize "JIT machine condition". However, this is just a point of view from the machine side. And it is necessary to consider from the total "Cost (Management)". When considering the best machine efficiency from corporate management, the best condition is to realize "JIT machine condition with the cheapest cost".

Therefore, it is one wrong way to realize "JIT machine condition" with maintenance costs uncontrolled.

c) Maintenance cost uncontrolled.

I introduce now some examples of the elements of cost uncontrolled.

1) Spare parts cost:

Spare parts also have to be subject to control, and a matter to discuss with the machine maker to share the stock is necessary: Proper stock control (parts No. & shelf No. in computer, computerized stock record & amount, proper storage method.

2) Maintenance yard control:

5Ss, tool control board, Tool maintenance, Tool list, maintenance of measuring equipment & calibration record.

3) Proper maintenance timing

In fact, it is a Reduction of Muda maintenance: Regular diagnosis & daily diagnosis (hearing the voice of machine & touching), Maintenance record & trend diagnosis, spare parts record in maintenance record & trend of exchange timing.

4) Maintenance technician

The number of persons (the organization), and Reduction of office work (computerize, delegation to the operator with computer terminal)

5) Oil leakage

Avoiding it in dialogue with the machine, regular diagnosis.

I think there are other Mudas in TPM activity. And please, never forget that PM activity is never a sanctuary from Cost.

d) TPM aims to get JIT machine at the cheapest cost

Again, TPM aims to realize "***JIT machine condition with the cheapest cost***".

And again, What Efficiency is? …By the way, when making the conclusion of this small-town factory after coming back to the class, they expressed a doubt.

They say that the machines are too old and slow. Therefore, this company needs to consider introducing more faster and multifunctional machines which have the function of quick exchange dies and are already commercially available. Then they discussed the theme of "what is efficiency" as a company.

For instance, again this factory has many old and slow original G-type Automatic Loon which has almost 100 years old. And, is this automatic loon bad efficiency? …As a company, the best efficiency machine is to realize "***JIT machine condition with the cheapest cost***".

Cheapest cost… yes, but how? …Cost = Variable-cost + Fixed-cost.

Thus, it is necessary to seek the cheapest. And, the cheapest Variable-cost is realized using Loss reduction in QC, and Changeover loss reduction. Although, this point has no remarkable

difference between old and newest machines. Thus, ***the most difficult enemy of JIT(Just in Time) is the lot size***.

Currently, the order lot size by a customer becomes high variety and small quantity, which means small lot size production.

Cheapest Fixed cost.

How to get the cheapest fixed cost? …The true character is mainly Labour cost and machine cost (depreciation).

And, how to reduce these costs in the above background? …Machine cost.

Output increase? …Uhm… Quick changeover? …It is OK. But… How about the machine cost such as depreciation? …For instance, let's say it's equivalent to 5 old automatic loons to one new high-speed machine. In both of the cases, the operator is one. Actually, that's likely 20 old and 5 new and output equivalents. Thus, old machines are cheaper than new machines, because of 0 depreciation. Remarkably, the old machine is cheaper, if the space cost is possible to ignore.

Labour cost

It must be even, because of having multiple machines and adjustable depending upon the necessary quantity.

Then, I required them to conclude the result of this visit with the KJ Method. Thereupon, the students questioned me why KJ? …And, my answer was that it is very convenient to conclude in (Like as) Relationship Diagram and also to come up with a new idea.

Now I require you to come up with an idea of why TPM is and also it is training to promote their thinking: "***Look Gen-Jitsu*** (reality) ***and generate new idea***".

And, the students questioned why KJ-Method is convenient? …My thinking, but it is not a piece of scientific evidence, and therefore it is not necessary to read more if you consider, is as next:

—Everyone —I started my speech—, a brain has 100 to 200 billion cells including cells deep in the cerebrum and cells in the cerebellum. And, in one theory, it might be used only 3% of total cells. However still tremendous numbers of cells we use. And —I continued…

—These nerve cells form hundreds of trillions of connections and make up a very complex and delicate circuit board. It is said that the communication of electrical signals occurring in the brain and the neural circuits of the brain are the "mind", which causes actions.

—So, regarding to the nerve cells, one of each cells has one unique idea. And when forming a circuit between cells, a flash of inspiration is generated….

—And —I continued—, accordint to KJ-Method, each one card is like one cell. Thus, connecting cards and generating flash of inspiration. In this way, I think, KJ map is small universe and small brain world —I told them when I tought that even It was just a little exaggerated, also it was a good andunderstandable analogy…

—And, for getting good flash, it is necessary the proper training also good environment such quiet, flowers, beautiful pictures, fresh air, good smell, natural environment. Probably the toilet environment of this president who makes thinking in meditation is near to such environment…

Anyway, their conclusion (by KJ method) of What TPM were: ***To seek "JIT machine condition with cheapest cost" & (Well maintained) Old machine is beautiful. Moreover the Extension of loved machine's lifetime.***

Going back to the main theme (Oil Control)

2. Oiling corrective method

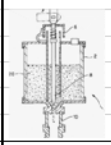
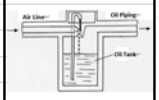
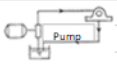
Oiling in the correct way means "***oiling and replenishing clean oil to the designated oiling port with the designated equipment***".

For this purpose:

1) Dirt of lubricating oil;
2) Dirt on oiling equipment;
3) Damage to the oiling filler port.

In this way, in order to the correct amount of lubricating oil to be supplied to the friction surface at the correct time, it is necessary to ensure that the lubrication is performed in the correct method. It is important to pay close attention to such factors, check the oiling method, and check the amount of oil. But in fact, it is quite difficult to choose the corrective oiling methods to depend on the variety of kinds of machines. Then for your reference, I would introduce easy guidance introduced by Professor Akio Nitanai (Tamagawa Univ.):

> *The oiling method is roughly divided into the Total loss method and the Iterative method. The types of each method are shown in the table below.*
>
> *The total loss type has a simple mechanism because the oil is disposable, but it requires the cost of consumables, and for maintenance, for example, it is necessary to pay attention to the oiling timing (interval). On the other hand, the iterative method requires a mechanism to hold the lubricating oil, which makes the structure a little more complicated but reduces the cost of consumables. It is also generally more reliable.*

Classification	Kinds	Outline	Application Range	Characteristic	Example
	Supply by hand	Provide a refueling port and refuel with a manual oiling device	Low speed/ Medium speed, Low load. Bearings, sliding parts, open gears, chains, wire ropes for intermittently operated machines	The device is simple and requires manual oiling. Be careful of dust entering from the oil filler port such as oil nipples and caps.	
Total Loss Type	Dropping	A fixed amount is constantly oiled from the pores with a drip type or bottle type oiling device.	Low and medium load bearings peripheral speed 4~5 meters/s or less.	Compared to manual oiling, it saves labor and is highly reliable. The amount of oiling can be adjusted. The supply amount changes depending on the temperature and oil level.	
	Candle wick	Always supplied from the oil cup using the capillary action of the wick.	Low and medium load bearings peripheral speed 4~5 meters/s or less.	The amount of oiling can be adjusted by the number of wicks. The supply amount changes depending on the viscosity, temperature, and oil level of the oil.	
	Mechanical	It is supplied at a pressure of 35MPa by a small plunger pump driven by a cam or motor of the machine body.	High speed, high load cylinders, sliding surfaces, press bearings	An appropriate amount can be supplied accurately at high pressure. Large quantity supply is not possible. Centralized oiling is possible up to 24 locations.	
	Concentration	An appropriate amount is supplied at an accurate interval and constant pressure by a single pump, distribution valve, and control device.	Low speed/ Medium speed, Medium load.	Centralized and automated is possible.	
	Spray	The oil mist generator turns the oil into mist with compressed air and supplies it through the piping together with the air.	High speed rolling bearing	Centralized and automated is possible. It can always supply the required amount of fresh oil. The cooling effect of air can be expected. There is a limit to the amount of refueling. Environmental pollution caused by oil mist.	
	Oil Bath	Lubricate the bearings and gears by sinking partially them in oil.	Low, medium and high speed bearings, gears.	Some cooling effect can be expected. Fluctuations in the oil level have a large effect on the amount of oil supplied and the cooling effect. Oil level control is important.	
	Splash	Oiling by beating or stirring the oil in the oil pool with a rotating body and splashing droplets.	Small/medium speed reducers, small and medium reciprocating compressors, internal combustion engines.	There is some cooling effect. Not suitable for low speed or ultra high speed.	
Circulation Type	Pad	Oil is sucked up from the oil pool by the action of the capillaries of the pad, and oil is applied and oiled.	Medium, low speed, medium load, railroad vehicles, crane axle bearings, drum bearings.	The complexity of refueling can be avoided. Be careful of clogging.	
	Ring Disk	Oil is pumped up and oiled by the rotation of the oil ring on the axis and the disk set on the axis.	Medium speed and low / medium / high load motors, centrifugal pump bearings.	A considerable cooling effect can be expected. Oiling will be insufficient when rotating at low speed or using high-viscosity oil. It cannot be used for the one on the vertical axis.	
	Circulation	Oil is constantly circulated and oiled by a forced circulation system with an oil tank, pump, filter, cooler, and piping system.	For large equipment machines (high speed, high temperature, high load)	The oiling layer, oiling temperature, and oiling pressure can be adjusted extremely finely and highly reliable. Great cooling effect.	

Professor A. Nitanai

Candle wick.

A lubrication device that utilizes the capillarity of a wick immersed in oil to allow an appropriate amount of lubricating oil to drip onto the lubricated area. Recently, it is being replaced by centralized lubrication and sealed lubrication because it is necessary to constantly monitor the dripping pause and replenishment.

A little more…, I would write about Deciding the oiling method. There are three main stages to consider.

1) Where to supply the lubricating oil.
2) How much lubricating oil is supplied (supply amount).
3) Which oiling method should be adopted.

1) and 2) can be roughly determined by the object that needs lubrication, but there are two factors regarding the oiling method, depending on the purpose of oiling.

The first is when pure lubrication is expected, and any lubrication method that can secure a fluid lubrication film is sufficient. The other is when the lubrication method must be expected to have a cooling effect in addition to the lubricating effect. In this case, it depends on how much you estimate the margin for the heat load on the friction sliding surface.

Regarding the spray oiling method, you can expect the cooling effect of compressed air, not the cooling effect of lubricating oil.

3. Maintaining cleanliness

Even if the sliding surface is fluid-lubricated, the oil film that is formed is generally about several tens of µm at the thickest. If the lubrication system is open, the risk of flying earth and sand entering the sliding surface increases.

Mixing of fine particles.

The particle size of the fine particles (sand) that fly up due to the force of the wind is about 100 µm when the particle size is large, and there is a risk of invading the sliding surface when the particles are small. The main component of sand is silica, which is comparable to the hardness of a grinding wheel, so if it invades the sliding surface, it will damage the shaft and bearings. As the damage progresses, wear powder is generated from the sliding surface, and it becomes hard due to work hardening or becomes an oxide and becomes hard, so there is a risk that the sliding surface will be further damaged. If these particles stay in the oil, the sliding surface will be damaged and it is necessary to remove these solid particles from the lubricating oil.

Moisture intrusion

In addition, when moisture enters, rust will occur. Rust is generated, and the separated particles also emit foreign matter.

Therefore, it is necessary to take measures to prevent foreign matter from getting into the oil and entering the sliding surface. The following are examples of countermeasures.

1) Prevent foreign matter from entering from the outside:
   Isolate the sliding surface with gaskets, oil seals, dust strips, etc.
2) Removal of solids in oil:

Especially for repetitive lubricators, a filter is inserted into the lubrication system to remove solids.

3) Cleaning of the lubrication system

When assembling the lubrication system, solid matter (contamination) is often found in the piping etc. at the initial stage. In plants, etc., foreign matter in the piping is removed by flushing (cleaning) at the initial stage.

4. The task of the operator

By whom oiling activity should be done? …**Yes, it is the role of the operators**. Really? …Of course. But it should be transferred in the process of the transition from PM to TPM.

Again, the steps of TPM introduction.

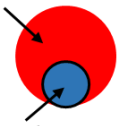
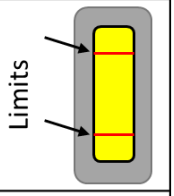
A. In the first stage of introducing TPM, it is necessary to establish a certain PM (Preventive maintenance) which is done by the maintenance department and technicians.
B. The second stage is the education & training and skill evaluation of operators.

Then,

C. Thirdly transferring the task to operators (of course based on a sound background of "***All people's participation***").

The operator's job role transferred is:

1) Always keep the friction and lubrication surfaces of machines and devices clean.
2) Keep oiling containers and equipment make Seiri & Seiton and clean.
3) Make sure that the mouthpiece and lid of the container are closed.
4) Be careful not to let foreign matter such as dust and moisture invade.
5) Indicate the type of oil used and the cycle label at the oiling point.

	Supply cycle		Kind of lubricant		Limit
Label	Label  Supply place: ***Supply mouth***		Cycle label  Kind of lubricant		 Limits
Symbol color		Daily		Operating fluid	
		Weekly		Machine	
		Monthly		Axis	
		Semi-annually			
		Annually			

And it is necessary to educate the points for handling lubricating oil. And, the points are

1) Do not put dust, dirt, moisture, etc. in it;

2) Do not mistake the type of oil;
3) Be careful about safety.

It is easy, isn't it? …However, it is important first step for transmitting PM to TPM. And please never neglect the education & training and evaluation sistem, even though it is easy.

Next:

4) Teaching and training the daily check points for oiling.

In daily inspection, the most important thing is to be familiar with the conditions during normal operation regarding the amount of oil, oil temperature, sound, vibration, etc.

The employees of the small-town factory know their machine condition like as their children. And, the points are

1) Is the lubrication part certainly oiled? …Periodically check the end;
2) Is it within the specified level range such as oil amount and oil temperature?
3) Is there an oil leak?
4) Is there any abnormality in the condition of the lubricating oil? …Discoloration, turbidity, foaming, etc.
5) Is there any abnormal sound or vibration?
6) How is the amount of oil reduced per unit time?

A little difficult? …These activities are as the second step for transmitting PM to TPM. And please pay attention to one point which is: ***Never allow "One's own way" of individual operators***. Therefore, it is necessary to standardize these activities. And a visual aid is very good idea.

5. Making Lubricating oil system diagram

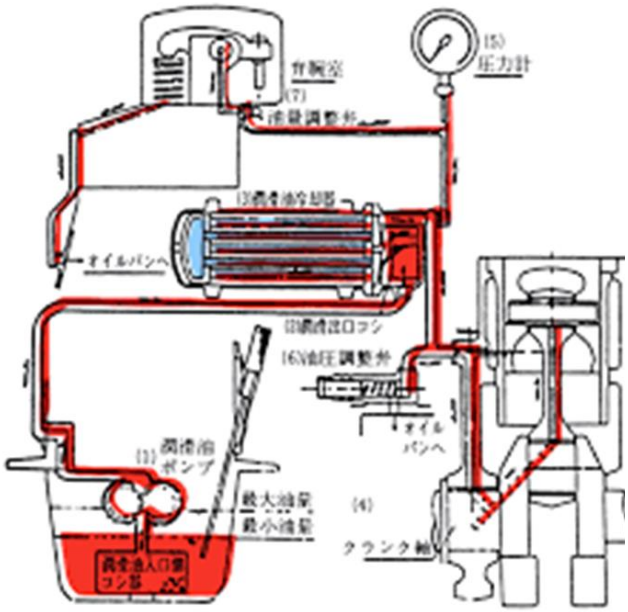
In the education & training, it is recommendable to make the Lubricating oil system diagram by the operators.

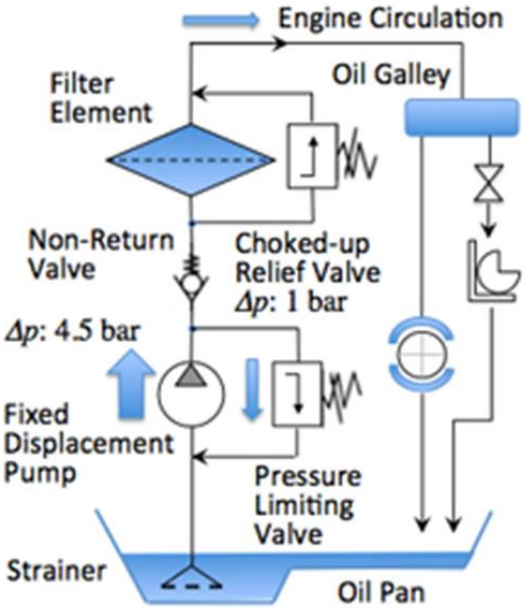
Even if you supply lubricating oil, it is necessary to make sure that the lubricated surface of the terminal is in good condition. For that purpose, the operator himself has to confirm the route from the lubricating oil inlet to the end of the pipe in the lubrication system. And the checking points are

1) Is the pipe crushed?
2) Is an appropriate amount flowing from the pipe?
3) Is there any oil leak from the joint?
4) How is the oil discharge status?

It is important to make a sketch while checking such things.

By the way the image of Lubricating oil system diagram, I searched an example in internet. There are many image examples such pictures below.





However, I don't recommend such (complicated) difficult activity. Rather than these, I recommend free hand pictures with using a photo of the machine. Because the purpose of making it is to understand the into ~ pass ~ end by the operators. And, it is recommendable to be a theme and make it by a QC Circle.

By seeing and touching with their own eyes and making sure that the lubricating oil is supplied to the end, they can operate the equipment with real peace of mind and raise awareness that they must oil.

Then, please use the QC-Circle and Group activities for this theme.

VI. Next lecure

I write Cost Reduction-3, Oil control-5 (final).

Koichi Kimura CC4 – August-2021.

Factory Management Institute